

Undergraduate Use of Mobile Devices for M-learning: Where Is the Niche?

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Abstract: *The paper explores how mobile technology can be appropriated as a tool to mediate mobile learning (m-learning) in the “right space” where meaningful learning occurs. The authors propose examining m-learning under two intertwined conditions of (a) the properties of the context that enable the effectivities of the mobile technology, and (b) student capabilities and interpretations to take learning actions. When these conditions are met, mobile technology is deemed to be appropriated at the “right space”. This space is termed as the “niche” for mobile learning, and learning taking place in the space is termed as “niche mobile learning (m-learning)” in this paper. Two individual case use of the mobile technology for learning in a university has been traced and examined over a one-year period. Data was collected and triangulated for analysis. The research findings show that the two cases appropriated mobile technology as a tool for mobile learning differently due to different “niches”. Discussions are made and implications are explored.*

Keywords: mobile devices, m-learning, technology affordances, undergraduate, student-led

1. Introduction

Mobile technology has become increasingly mainstream in the support learning in higher education. Paralleled with this are different understandings of mobile or m-learning. M-learning no longer means that learning happens when the learner is moving with the device, but means that learning happens when the learner is moving with the whole learning environment (Sølvberg & Rismark, 2012). This definition recognizes the importance of the learning environment that transcends physical settings. From this definition, m-learning is more concerned with the unique characteristics of the mobile technology: mobility, immediate accessibility and connectivity (Song, 2013). Hence, this technology supports “just-in-time” and “just-in-place” m-learning.

This study examines the “right space” for “just-in-time” and “just-in-place” meaningful m-learning. This space is termed as the “niche” for mobile learning, and learning taking place in this space is termed “niche mobile learning” in this paper. This paper describes a framework for studying niche m-learning, and includes research methods, data analysis followed by discussions and a conclusion.

2. Niche M-learning and Its Conceptual Framework

To examine learning, Edward (2005) proposes two intertwined focuses, with a strong Vygotskian legacy, on (a) how learners interpret and act on their worlds, and (b) the opportunities afford them for those interpretations and actions. This view is in line with Jonassen, Hernandez-Serrano and Choi’s (2000) conviction that learning technologies are tools for mediating the practice of learning, and if we examine the potential of learning technologies from the learners’ perspectives, then “the affordances of any [learning] technology are the properties of that environment that enable the effectivities of the technology, the abilities of the learner to take learning actions” (p.113). This is to say that technology tool mediated learning, results from not only the possibilities that the environment provides to put the tool into use for learning, but also the learner’s interpretation of the possibilities for taking learning actions. Thus, to examine learning in technology-rich environments, we need to consider three components: the affordances of the technology, the learner

interpretations and the context in which learning takes place.

The three components interact with each other simultaneously to make m-learning occur (See **Figure 1**). If the context allows the affordances of mobile technology to be put into practice (Area A), but without the learner or the agent, the affordances cannot be appropriated for learning; if the student perceives the affordances of mobile technology to use the technology (Area B), but the context does not enable the technology to be put into practice (e.g. in a lecture room where no mobile device use is allowed), m-learning cannot happen; if the context enables the student to use the technology for learning (Area C), but the technology is broken down, then m-learning cannot be achieved. Whereas, when the context enables the effectivities of mobile technology and the student perceives the affordances, is willing to take learning actions (Area D), then “just-in-time” and “just-in-place” m-learning can be achieved. To put it another way, when the conditions of (a) the properties of the context that enables the effectivities of the mobile technology, and (b) student interpretations and willingness to take learning actions are met, the mobile technological tool is deemed to be used at the “right space” where meaningful learning occurs. This space is termed as the “niche” for m-learning, and learning taking place in the space is termed as “niche m-learning” in this research. Then the following two questions arise: 1. How did niche m-learning occur? and 2. What types of niche m-learning occurred?

These are the questions that this study attempts to answer. The “framework of examining niche m-learning”, outlined in Figure 1, is used to investigate the “what” and “how” research questions.

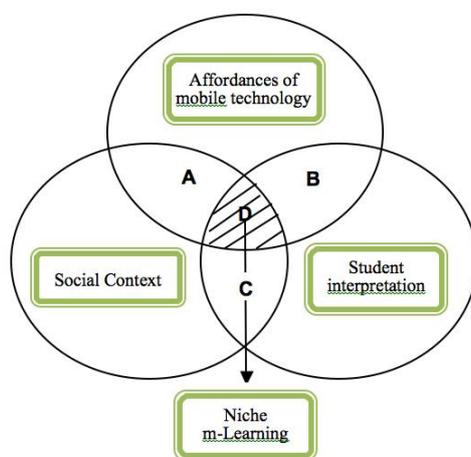


Figure 1. Framework of examining niche m-learning

3. Methods

This study examined niche m-learning through a one-year qualitative research adopting a multiple-case study approach (Yin, 2013). Multiple-case study offered a deeper understanding of the processes and outcomes of student mobile technology use for learning.

3.1. Participants

Participants in this research were five first-year undergraduate students with synonyms of *Ken, Ling, Hong, Juan and Ling* from different academic departments at a university. This included two females and three males. Four of the participants were local Hong Kong permanent residents, and one female participant was from Mainland China. As each of the five participants was from a different department, each of them was to be studied individually with respect to their mobile device use for their studies. Each participating student was given a smartphone and a mobile service package for one year use, free of charge.

3.2. Data Collection and Analysis

To understand students' interpretation and use of affordances of the mobile device for m-learning in context, data collection instruments employed in this study included: student reflective e-journals, student artifacts - a collection of smartphone screenshots that showed what the students did using the mobile device to support their learning, retrospective interviews based on the questions arising from reading students' e-journals and artifacts, face-to-face interviews, observations, follow-up interviews, field notes and memos. The multiple sources of data provided the opportunity to gain a holistic understanding of students' mobile device uses for m-learning grounded in the research.

The data analysis process was an ongoing and iterative process, in tandem with data collection. Three complementary streams of data analysis were involved: (a) "a preliminary exploratory analysis" was used to obtain an understanding of the data (Creswell, 2008, p. 250); (b) categorizing strategies were used to code categories of affordances, context factors and student interpretations of mobile device use of the two participants that contributed to niche m-learning (Maxwell, 2012); and (c) contextualizing strategies were employed to understand how various types of niche m-learning occurred (Maxwell, 2012). The data was analyzed with the assistance of Nvivo, the qualitative analysis software.

To explore "How niche m-learning occurs", categories of the affordances of the mobile device were developed and coded and factors in the social context that influenced mobile device use, and student interpretations in particular contexts were reviewed. To find out "What types of niche m-learning occurs", we coded the affordances, contextual factors and student interpretations once again to categorize types of niche m-learning based on the purposes the affordance was used in particular contexts, with individual student interpretations. In addition, in coding and categorizing types of niche m-learning, we also referred to Jonassen et al. (2000)'s way of matching affordances of constructive technologies with particular types of learning approaches presented in Table 1.

Table 1. Affordances of technology tools for learning.

Technology	Learning Approach	Technology	Learning Approach
Computer supported collaboration	Learning by working	Videography	Learning by visualizing
Electronic performance support systems	Learning by performing	Multimedia construction	Learning by constructing
Simulations and microworlds	Learning by experimenting	KB communities and CSCL	Learning by conversing
Intentional information searching	Learning by exploring	Mindtools-cognitive tools	Learning by reflecting

After several repeated coding sessions, we were able to extract 10 conceptualized categories of affordances of the mobile device, and student interpretations. However, this categorization did not enable the examination of how different types of niche m-learning happened over time – in short, the evolutionary process of niche m-learning. Therefore, contextualizing strategies were adopted to investigate this process. By connecting the affordances of the mobile device, contextual factors and student interpretations, ten types of niche m-learning were conceptualized, and the process of niche m-learning was revealed. The next section presents the results.

4. Results

4.1. Ten Conceptualized Affordances of the Mobile Device

In this research, based on data sources from the five participating students, the mobile device features that share similar functions were categorized into one conceptualized affordance. There were altogether ten conceptualized mobile device affordances that were identified. These are: *resource access*, *resource collection*, *communication*, *representational*, *constructional*, *resource sharing*, *location-aware*, *scheduling*, *analytical*, and *productivity affordances*. Table 2 illustrates categories of mobile device affordances and their descriptions. These affordances were classified based on 891 data sources of e-journals, artifacts, various interviews, field notes and observational data collected from

the five students.

Table 2. Conceptualized mobile device affordances and their descriptions.

Mobile Affordances	Descriptions
Resource access	Accessing resources downloaded/stored in the device or accessed via internet
Communication	Communication via various channels such as SMS, phone call, email, and MSN
Resource collection	Collecting audio, pictorial, and text data in varied contexts
Scheduling	Managing schedules using Calendar, Tasks, or Excel
Representational	Creating representations on the device using images, drawings, pictures, video clips
Constructional	Writing and editing work using Word, or other software
Resource sharing	Sharing files by connecting the device to others via Bluetooth or Infrared
Location-awareness	Locating places using mapping software
Analytical	Helping process certain data using Excel or downloaded graphic calculator software
Productivity	Helping manipulate and calculate numbers using calculators

The dominant categories of affordances outlined in Table 2 used by participants were resource access (37.1%), followed by communication (20.1%) and resource collection (16.4%). Lesser-used affordances were: scheduling (9.2%), representational (7.4%), constructional (3.5%), resource sharing (2.4%), location-aware (1.8%), productivity (1.2%) and analytical (0.9%) affordances.

Each participant's use of the affordances of the mobile device is different which is shown in Table 3. It was observed that all the participants made much use of the affordances of resource access and communication tools frequently. Ling, Juan and Kan also made much use of the resource collection tool. The least used tools were constructional, resource sharing, location-aware, analytical and productivity tools.

Table 3. Percentage of each participant's use of each mobile device affordance.

Participant Affordances	Percentage of each participant's use of each mobile device affordance				
	Ling (239)	Juan (133)	Kan (206)	Lei (151)	Hong (161)
Resource access	39.3	28.5	27.6	44.8	44.2
Communication	22.6	29.3	25.0	24.1	26.3
Resource collection	19.2	27.1	20.7	8.3	4.4
Scheduling	6.6	6.8	5.9	15.9	13.8
Representational	3.4	4.5	11.9	2.8	4.4
Constructional	4.2	0	1.5	4.1	5.6
Resource sharing	1.3	2.3	2.5	0	0
Location-aware	0	0	3.9	0	0
Analytical	0	0	1.0	0	0
Productivity	3.4	1.5	0	0	1.3
<i>Total</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>

It is clear that affordances of mobile devices co-exist with constraints (Song, 2013). Constraints refer to whatever mobile device hardware or software constraints such as the relative small screen size, lack of grammar and spelling check software that made it difficult for the students to use the device.

4.2. Social Contextual Factors

As is noted, the student niche m-learning was examined in a framework of relationships between affordances of the mobile technology, the social context, and the student capabilities and interpretations of the social context. In contextualizing the mobile device use of the five participants through data analysis, the research findings reveal that mobile device use was mainly affected by the interacting factors of *tasks, learning resources, time and place, and institutional factors*. These factors and their corresponding descriptions are shown in Table 4.

Table 4. Social contextual factors and their descriptions.

Social contextual factors	Description
Tasks	Tasks include (a) assigned tasks, (b) self-defined tasks and (c) emerging tasks. Assigned tasks refer to tasks that were assigned by the professor or required by the University. Self-defined tasks refer to tasks that students defined by themselves such as exam preparation, and reading online newspapers. Emerging tasks refer to tasks that emerged opportunistically in academic studies, particularly when tasks were time-sensitive such as consulting dictionary when encountering new vocabulary words, and exploring information online just-in-time.
Learning resources	Learning resources include (a) learning material such as hardcopy and soft copy lecture handouts, and other course related materials provided by the professors; (b) learning material explored, collected and created by students; (c) available technologies such as computers, other handheld devices; and (d) social support from peers, friends, professors and tutors with whom students interacted using the mobile device.
Time and place	Time and place of use refers to when and where the student used the mobile device. Time of use includes whenever the mobile device was used such as in lectures, meetings, during breaks, while commuting, and doing self-studies. Place of use includes wherever the mobile device was used such as in physical buildings, on campus (outside physical buildings), and on public transports (e.g., bus, MTR).
Institutional and community culture	Institutional factors refer to institutional practices in terms of required exams, assignments, policies regarding the awarding of degrees, support regarding learning resources and facilities provided for the students. The culture of the community refers to the culture in which the individual student was raised or situated

4.3. Student Interpretation

Mobile devices are useful only when users perceive their potential and use them in context (Oliver, 2005). Different users interpret the context in which the tools are embedded differently. This is true for the students in this research. In the current research, we also identified these coping strategies among the participants using contextualizing strategies shown in Table 5. Holding clear goals of obtaining a first-class honors degree, Kan had the best agency in using the mobile device affordances to maximize his niche m-learning opportunities, followed by Ling and Hong. All of the three participants perceived the usefulness of the device for learning, and were keen on finding new ways of using the device to achieve their learning goals. They tended to adopt task-oriented coping strategies. However, Juan did not set up challenging goals for her study. In many cases, she was not enthusiastic in her learning and had low expectations for excelling other students. If the mobile device could help her pass exams, she might use it although she might find many reasons to give up the use when she encountered some constraints of the device. Thus, Juan tended to take ego-defensive copy strategies in using the device. Lei was an enthusiastic participant. Unlike the other participants, he was more interested in broadening knowledge and keeping close relationships with the professors for consulting knowledge that was beyond the textbooks. He made use of the device quite often for enriching more information or communicating with the professors for seeking help and advice. Thus, he tended to adopt a social-dependence type of coping in using the mobile device for learning.

Table 5. Factors related to student interpretation of the mobile device use

Participant	Goals	Motivation	Prior experience	Coping strategies
Ling	To obtain a bachelor degree and become a journalist	To improve English in speaking and writing	Never used a smartphone to support learning	Task-oriented coping,
Juan	To pass exams and assignments	Not to have make-up exams	Never used a smartphone to support learning	Ego-defensive coping
Kan	To obtain a first-class honors degree	To get high scores in every subject	Two-year experience in using a smartphone	Task-oriented coping
Lei	To obtain a bachelor degree and broaden knowledge	To enrich learning experiences	One-year experience in using a smartphone	Social-dependence type coping
Hong	To obtain a bachelor degree and become an interpreter	To improve interpretation skills	One-year experience in using a smartphone	Task-oriented coping

4.4. Types of Niche M-learning

Based on the contextual factors and personal interpretations, the conceptualized mobile device affordances were further analyzed using contextualizing strategies one by one for varied types of niche m-learning. The findings show that a certain type of niche m-learning can be realized by using different affordances of the mobile device. Descriptions of niche m-learning offered by different affordances are shown in Table 6.

Table 6. Mobile devices affordances and their uses for varied types of niche m-learning

Niche m-learning	Mobile device affordance	Description
Reflecting	Resource access	Accessing recorded lectures, online or downloaded material to improve topic understandings
	Resource collect	Capturing notes/recordings of lectures in class to better understand course material afterwards
Collaborating	Resource access	Accessing information shown on the mobile device together with peers for discussion
	Communication	Communication to discuss and share and working together via phone calls and MSN
	Resource sharing	Facilitating collaborative work by sharing files via the mobile devices to other devices
Instructional	Resource access	Accessing downloaded material and learn it by heart to improve skills in a subject area
	Location-aware	Locating places by referring to downloaded MapKing software
Exploring	Resource access	Accessing the internet to search for and find useful online information to support studies
Visualizing	Resource collection	Photographing lecture slides or images to better understand course material through visual representations afterwards
	Representational	Representing created images or video clips on the device to improve understanding material and/or to analyze the material either individually or collaboratively
	Analytical	Visualizing data relationships using graphic calculating software to support studies
Conversing	Communication	Communicating to seek advice and/or instructions from others via phone calls, and emails
Constructing	Constructional	Creating, editing or drafting documents, such as assignments and reports using Word Mobile, or other downloaded software
Socializing	Communication	Communicating for socializing the purposes via phone call, email, SMS, MSN
Organizing	Scheduling	Managing study, social and personal related activities using Calendar, Tasks, and Excel, etc.
Efficiency	Productivity	Improving efficiency by using the Calculator function on the mobile device

5. Discussions

The findings show that the five students used altogether 10 conceptualized affordances of the mobile device for 10 types of niche m-learning. Each student's interpretation of the context and affordances was different, which contributed to different types of niche m-learning. We discuss how niche m-learning happened or did not happen due to the three interacting components – affordances of the mobile device, social context and student interpretation as follows.

5.1. Affordances + Social Context – Student Interpretation ≠ Niche M-learning

It is noted that in this research, although different students perceived the same affordance of the mobile device in the similar social context, different students with different goals and motivation, prior experience and copying strategies, interpreted the opportunities and constraint of the context differently. Hence, the individual interpretation interacted with other factors in context that contributed to different decisions on the same mobile device use using different coping strategies. For example, Juan's original goal of using the mobile device as a resource collection tool take pictures of lecture slides was for her course exam preparation. However, because of the poor quality of the images, she conceived that the picture quality was not good enough to help her study without taking any other actions. Her coping strategy was "ego-defensive coping" - She was more sensitized to the difficulties and the demand aspects of tasks than need aspects. By contrast, Ling made use of the tool to photograph lecture slides with images that were not included in the lecture notes also for her course exam preparation. Although the captured pictures were blurred, she still deemed that the pictures were useful for her to improve her learning by *contrasting the images afterwards* in order to understand the skills of photo-taking for news report. Her coping strategy was "task-oriented coping", meaning that she did not believe the task was not insurmountable and was enthusiastic to explore ways to take advantage of the mobile device to support

her study.

The results of this research show that students' individual interpretations played an important role in making their decisions on niche m-learning. Even though the student could perceive the affordance of the mobile device and the context allowed the use of the affordances, the student's negative interpretations resulted from her goals, tasks and copying strategies could not lead to her niche m-learning.

5.2. Affordances + Student Interpretation – Social Context ≠ Niche M-learning

If the social context regarding tasks, resources, institutional / community and time and place factors did not enable the student to use the tool to take action, niche m-learning could not take place. For example, Ling was motivated to use the mobile device as a representational tool to view video clips provided by one of her journalism professors to help improve her understandings of abstract concepts. However, she claimed that only one of her professors provided her with video resources. *Lack of appropriate learning resources as an institutional factor* prevented her from making further use of the tool to perform the *related learning tasks anytime, anywhere*. The mobile device itself is only a package of conceptualized tools. Niche m-learning cannot happen without making use of learning resources through the mobile device tool.

Kan used to use the mobile device as a resource collection tool to record lab results immediately after the experiments. However, during the second half of the one-year period of the study, Kan's lab experiments focused more on abstract computer programming and modeling tasks. The results of these types of lab experiments could not be easily recorded using the resource collection tool. Therefore, the resource collection tool use could not take place in this particular context due to a *lack of appropriate tasks*. In this study, even though Kan wanted to make use of the device for helping lab experiments "just-in-time and -place", without suitable tasks, such niche m-learning could hardly happen.

5.3. Social Context + Student Interpretation – Affordances ≠ Niche M-learning

New forms of technology can be enabling as well as constraining. It is the same with the mobile device. However, how the students used the affordances of the mobile device is shaped but not determined by the enabling and constraining properties of the mobile device. The enabling and constraining properties of the mobile device are those characteristics that permit or inhibit the abilities of the students to use the device to perform various tasks.

Some of the affordances of the mobile device were perceived but discarded the uses because of the constraints of the mobile device in some situations. Juan tried to use the mobile device as a resource collection tool to record lectures after she transferred to the Department of Biochemistry. However, the inferior quality of the recording prevented her from making further use of the tool for reflective purposes. Lei tried to use the mobile device as a resource access tool to access downloaded course handouts. However, because the constraints of the screen size, he felt "sick", and not comfortable in his eyes. The physical discomfort inhabited his motivation to use the device for learning.

5.4. Affordances + Social Context + Student Interpretation = Niche M-learning

Tools cannot impose on the users to use them. They are useful only when users perceive their affordances and use them in context (Oliver, 2005). Different users interpret the context differently. This is true for the students in this research. The "subjective interpretations" of the context can either make students negatively anticipate learning to happen or support spontaneous involvement in a learning task (Järvelä, Hurme, & Järvenoja, 2011). The interpretations of the context are closely related to the goals and motivations of the student in question. Students perform best if they are actively involved in tasks and integrate new information with their prior knowledge to achieve their goals (Lajoie et al., 2014). Oliver (2005) posits that, as users, students are not only "tool using", but also "tool making" (p. 142). Oliver further suggests that research on affordances of tools for educational practices should focus not only on the offered possibilities, but also on what students imagine might be possible, and what they can imagine doing to achieve the same end with some other tool. If a tool does not allow them to undertake a certain action, they can "find an alternative or

Wu, Y.-T., Chang, M., Li, B., Chan, T.-W., Kong, S. C., Lin, H.-C.-K., Chu, H.-C., Jan, M., Lee, M.-H., Dong, Y., Tse, K. H., Wong, T. L., & Li, P. (Eds.). (2016). *Conference Proceedings of the 20th Global Chinese Conference on Computers in Education 2016*. Hong Kong: The Hong Kong Institute of Education.

make a new tool that does” (p. 412). In this study, Kan’s mobile device use was nurtured and embedded in the practical accomplishment of authentic tasks in context and by making use of offered possibilities as well as creating imagined possibilities to make niche m-learning happen (Song, 2013).

6. Conclusion and Implications

This study investigated how niche m-learning occur and what types of niche m-learning occurred under the “framework of examining niche m-learning” consisting the three interacting components: the affordances of the mobile device, the learner interpretations as well as the context in which learning takes place. Niche m-learning happen only when the conditions are met: (a) the properties of the context that enables the mobile device to be put into use, and (b) student interpretations and willingness to take learning actions. Although it is demanding to lay two focuses simultaneously on examining learning actions mediated by mobile devices, it is advisable for educators, practitioners and designers to maximize the possibilities that the context provides for mobile device use to support student learning. In order to maximize the possibilities of mobile devices for learning, future research should shift from emphasizing technical aspects of developing and designing mobile learning systems to pedagogical practices and social context, especially in terms of pedagogic designs, resources development and provision, pedagogically sound mobile technology tool development, and institutional support for learning to happen just at the “right space”, i.e. for “niche m-learning” to take place.

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